Syllabus for PhD Clinical Biochemistry

Unit-1. Molecules and Their Interaction: Structure and function of biomolecules (carbohydrates, proteins, lipids, nucleic acid, vitamins); energetics and regulations of glycolysis, Krebs cycle, HMP shunt, glycogenesis and glycogenolysis, transamination and deamination, urea cycle, fatty acid synthesis and oxidations, de novo and salvage synthesis and metabolism of purines and pyrimidines, vitamins and minerals roles; disease and inborn error associated with the biomolecule metabolism; enzymes and enzyme kinetics

Unit 2. Organ function test: Liver function test; kidney function test; pancreas function test; thyroid function test; cardiac function test

Cell signaling: Endocrine system and hormone; hormones receptors, cell surface receptor cellular signaling, signal transduction pathways; G-Protein Coupled Receptors, Receptor Tyrosine Kinases, G protein, ras and rho family signaling; primary messenger and secondary messenger.

Unit 3. Molecular Biology of cells:DNA replication, repair and recombination (Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination); RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport); Protein synthesis and processing (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post- translational modification of proteins).

Unit 4. Immunology: Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules. generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell- mediated immune responses, primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies, vaccines.

Unit 5.Recombinant DNA technology: Isolation and purification of nucleic acids; amplification of DNA using PCR, recombinant PCR, Asymmetric PCR, nested PCR, use of restriction and modification in enzymes in cloning, plasmid vectors, λ phage, BAC, PAC, random and site directed mutagenesis, DNA sequencing, next generation sequencing, Principle and applications of southern, northern and western blotting, Recombinant protein expression and purification in different host systems.

Unit 6. Analytical techniques: Chemical and enzymatic methods of carbohydrate analysis, separation and identification of carbohydrates, lipids and amino acids mixtures; principle and methods of protein separation techniques, basic of chromatography-gel filtration, Ion exchange, affinity, HPLC, HPTLC, FPLC, Electrophoresis- SDS, AGE, IEF, protein-protein interaction, immune-precipitation; Basic of Spectroscopy-UV-Vis, Fluorescence, CD, FTIR, NMR, X-ray crystallography, SPR; Basic of Microscopy- light, fluorescence, confocal, electron microscopy, phage-contrast, super-resolution; Radioactivity and radioisotopes, detection and measurement of radioactivity and Cerenkov counting